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Technical objectives:

The first objective was to educate and train students to collect and analyze meteorological and oceanographic data using the developing CCNY weather station computer system.

The second objective was to purchase the necessary software and hardware to keep the system up-to-date.

The third objective was to teach students scientific programming.

Technical accomplishments:

First objective:

The computer system was used to collect and analyze Geosynchronous Orbiting Environmental Satellite (GOES) images of the eastern Pacific to identify ship-produced clouds. The images were used by Graduate student Najita (1994) to study the occurrence of the clouds and the meteorological conditions. She found an apparent relationship between the location of the clouds and the location of the Pacific high pressure region. The relationship may be useful in forecasting ship-produced cloud events.

Najita (1995) used TeraScan software to analyze NOAA Advanced Very High Resolution (AVHRR) images in her study of ship-effluent effects on marine stratocumulus clouds. She earned her M. A. in 1995 with this study.

Undergraduate student meteorologist K. Kong collected and analyzed the GOES satellite images used by Hindman, et al. (1994); the reported cloud line appeared to be due to ship-produced particles and updrafts. Kong's analyses were crucial in determining which ship produced the cloud line.

The system was used by undergraduate student-meteorologists Edward Kannar and Kwan-Yin Kong to collect and analyze high-resolution, hourly, satellite images of the eastern Pacific to identify ship-produced clouds during the ONR-sponsored Monterey Area Ship-Track (MAST) experiment, June 1994. The archived images were a unique resource to the experiment.

During the PI's sabbatical (Academic year 1994-95) at Tribhuvan University, Kathmandu, Nepal, the TeraScan software for analyzing AVHRR images was used by graduate research assistant Kwan-Yin Kong and high school apprentice Chetan Prabhu. They acquired images of Nepal from the NOAA online Satellite Active Archives, analyzed the images and e-mailed them to Kathmandu. These images were used to assist studies conducted by the PI and his TU colleagues. The images were unique in Nepal and, hence, valuable. This work significantly assisted meteorological analyses of Hindman (1997) and Hindman and

Upadhyay (1997).

The summers of 1993 through 1996, the laboratory was the central site for Project *WeatherWatch*, an NSF-funded NYC teacher-training institute. In fact, the activity in the laboratory generated by the ONR support helped stimulate the project. The educated and trained teachers returned to their classrooms to use newly acquired meteorological and oceanographic data from their Internet sites. Thus, indirectly, the ONR supported touched more students in the NYC region than just CCNY students.

Second objective:

The systems engineer (David Ahn, Ph. D. candidate in Electrical Engineering) designed and constructed a novel local-area network which attached four PC work stations to the IBM RISC 6000. He also connected the RISC to the outside world through Internet. As a result, our weather station could be used for teaching, research and data reception and transmission on Internet.

Further, David installed a Sun Sparc-20 and TeraScan software to display and analyze the NOAA satellite images graduate research assistant Theresa Najita collected during the MAST experiment. He also connected the Sun to Internet allowing TeraScan-analyzed images to be e-mailed to the PI in Nepal..

The EAS Department computer system configuration as of May 1997 is depicted in the attached figure. At the beginning of the ONR award, only two IBM PS/2 machines were in the system. As can be seen, the award greatly stimulated the modernization of the Department's computer facilities. The ONR support has significantly enhanced the teaching, research and service activities in the EAS Department. Currently, we are seeking funds from NSF for a projection system to bring Internet products into the classroom.

Third objective:

Undergraduate research assistant Robert Bodowski, a meteorology major, performed the computations reported by Hindman and Bodowski (1994, 1996) and Hindman (1996). He investigated the role of ship-produced particles and updrafts on the modification of a marine stratus cloud; the particles were computed to play the dominant role. He also began to adapt the cloud and precipitation formation model of Silverman and Glass (1973) to study the effects of ship effluents on the formation of drizzle within marine stratus.

Graduate research assistant Robert Arnold (M.A., CCNY, 1993) helped the PI's colleague Prof. Stan Gedzelman develop a cloud microphysical model which was used to explain the form of cyclonic precipitation (Gedzelman and Arnold, 1993). Also, Robert helped develop a model that explains the isotopic composition of precipitation (Gedzelman and Arnold, 1994).

Graduate research assistant Xiaoping Zhang (M.A., CCNY, 1995) collaborated with the PI's colleague Prof. Stan Gedzelman to develop a numerical model that attempts to explain the isotopic composition of precipitation in a hurricane (Zhang, 1995).

Summary:

Computer hardware and software were obtained and configured so students and faculty could collect and analyze real-time and historic meteorological and oceanographic data in support of teaching and research activities. This led to a NSF-funded secondary school teacher training institute. The entire EAS Department computer system has been enhanced because of these activities. Currently, we are seeking support to bring a portion of the laboratory systems into the classroom.

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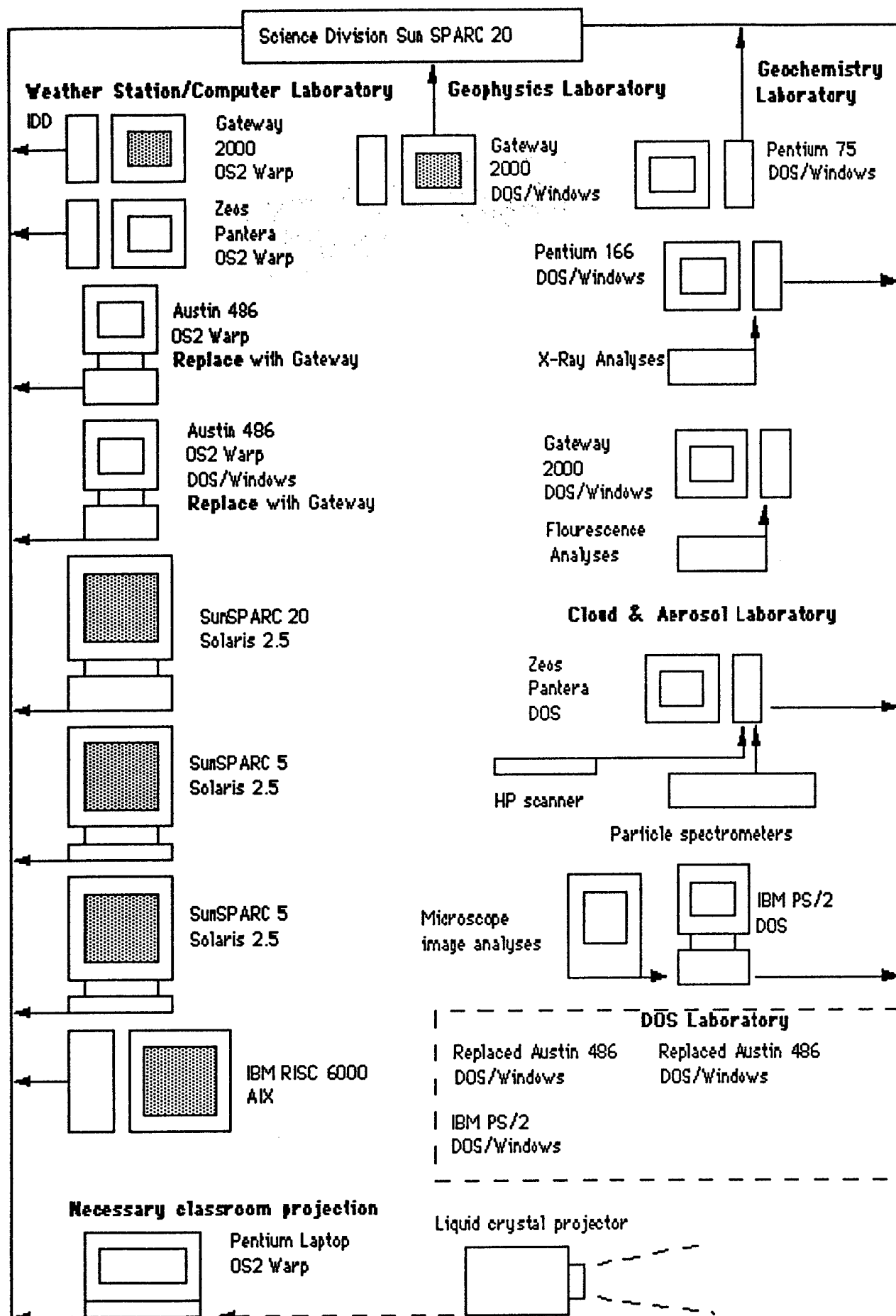


Figure: CCNY EAS Department computer system as of 5/97. Machines with the stippled screens were purchased with the ONR grant.